



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

09/885,744

06/20/2001

Hiroaki Niimi

TI-32705

5587

23494

7590

03/13/2003

TEXAS INSTRUMENTS INCORPORATED
P O BOX 655474, M/S 3999
DALLAS, TX 75265

EXAMINER

NGUYEN, KHIEM D

ART UNIT

PAPER NUMBER

2823

DATE MAILED: 03/13/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/885,744

Applicant(s)

NIIMI ET AL.

Examiner

Khiem D Nguyen

Art Unit

2823

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 10 December 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-16 is/are pending in the application.
- 4a) Of the above claim(s) 14-16 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-13 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 01 September 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other: _____

DETAILED ACTION

The non-final rejection as set forth in paper No. (8) is withdrawn in response to applicants' amendments.

A new rejection is made as set forth in this Office Action.

Claims (1-13) are pending in the application.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1 and 6 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1 recites the limitation "minimum oxidation rate" in lines 11-12. It is unclear what rate is recited.

Claim 6 recites the limitation "wherein said N₂O/H₂ mixture contains 0.5 to 30 % (preferred 1 %) H₂ with the balance N₂O" in lines 1-3, the use of a narrow numerical range that falls within a broader range in the same claim may render the claim indefinite when the boundaries of the claim are not discernible. Also, the claim must recite the basis of the percentage.

Claim 8 recites the limitation "transistor" in line 3. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

Art Unit: 2823

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Huang et al. (U.S. Pub 2002/0146914) in view of Daniel et al. (U.S. Patent 6,235,590) and Park et al. (U.S. Pub 2001/0027004).

Huang discloses a method for forming an integrated circuit structure, comprising the steps of (FIGS. 1-5 and related text):

providing a substrate 11 having a semiconductor surface (page 2, paragraph [0018]);

forming an oxygen-containing layer 104 on the semiconductor surface wherein the oxygen containing layer is an ultra-thin silicon dioxide layer in the thickness range about 1.5 nm such that the oxygen-containing layer is an oxynitride layer and wherein the step of forming an oxide is a rapid thermal oxidation; and

re-oxidizing the layer by a rapid anneal step in a mixture of N₂O and H₂ wherein the anneal steps comprises 20 s or more at 1050 °C in N₂O/H₂, flowing at lower than 10 Torr (page 2, paragraph [0019]) and wherein N₂O/H₂, mixture contains less than 1 atomic % H₂ with the balance N₂O (page 2, paragraphs {0021} and [0022]);

Huang fails to explicitly disclose forming a uniform nitrogen distribution throughout the oxygen-containing layer as recited in present claim 1.

Daniel discloses forming a uniform nitrogen distribution throughout the oxygen-containing layer (col. 2, lines 39-42) and a method for forming an integrated circuit structure includes a transistor having a conductive gate structure 30 disposed on a gate

dielectric layer 18 wherein the conductive gate is comprises of doped poly-silicon and wherein the gate dielectric is an ultra-thin silicon dioxide and further comprising the steps of forming source and drain 22 and their respective contact to complete the transistor (col. 2, line 58 to col. 3, line 39 and FIG. 1). It would have been obvious to one of ordinary skill in the art of making semiconductor devices to combine the teaching of Huang and Daniel to enable a uniform nitrogen distribution throughout the oxygen-containing layer of Huang to be formed and further more to improve performances of the devices.

Huang fails to explicitly disclose re-oxidizing the oxygen-containing layer by a rapid anneal step in an oxidizer and hydrogen mixture of N_2O and H_2 for stabilizing the nitrogen distribution at minimum oxidation rate, healing plasma-induced damage and reducing interfacial defect density as recited in present claim 1. However, the disclosed process above would obtain the recited results because the same materials are treated in the same manner as in the instant invention. Alternatively, the steps could be employed in a process where the recited results are obtained. The claim does not require obtaining the results recited in use of "for".

Neither Huang nor Daniel discloses wherein the integrated circuit structure includes a capacitor having a capacitor dielectric as recited in present claim 13.

Park et al. discloses an integrated circuit structure includes a capacitor having a capacitor dielectric and further comprising the steps of (See col. 1, paragraph [0018] and FIG. 1):

Art Unit: 2823

forming a first electrode 5 over the substrate 1, the semiconductor surface present at the first electrode; and

forming a second electrode 9 on the dielectric layer 7 wherein the dielectric layer forms the capacitor dielectric. It would have been obvious to one of ordinary skill in the art of making semiconductor devices to combine the teaching of Huang, Daniel and Park et al.'s to enable the capacitor having a capacitor dielectric of Huang to be formed and further to reduce the leakage current density (col. 1, paragraph [0008]).


Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Khiem D Nguyen whose telephone number is (703) 306-0210. The examiner can normally be reached on Monday-Friday (8:00 AM - 5:00 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Chaudhuri Olik can be reached on (703) 306-2794. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 746-9179 for regular communications and (703) 746-9179 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

K.N.
March 4, 2003


George Fourson
Primary Examiner
2823